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THE DIAGNOSIS OF POLIOMYELITIS.*

By CHAS. H. HALLIDAY, M.D., Epidemiologist, California State Board of Health.

In 1909 the Census Bureau had twenty-four terms for the disease. It would, therefore, seem wise to adopt a uniform terminology. Poliomyelitis seems to be the best term. The question of classification is somewhat difficult, inasmuch as the clinical manifestations of the disease do not always correspond to the pathological findings. The lesions are scattered throughout the whole nervous system, so that, while certain definite types may be described, there will always be cases which come partly under one group and partly under another. A classification simply facilitates the description of the disease.

The study of recent epidemics has shown a great variability in the affliction, but practically all of the cases show the effects of an acute infection as prodromal signs. The later course of the disease, dependent upon the location chiefly involved, permits a separation into several types.

Prodromata are usual, varying in different epidemics. They consist of fatigability, loss of appetite, slight digestive disturbances with nausea, looseness of bowels, bronchial irritation or coryza with slight elevation of temperature. Conjunctivitis may occur and lymphatic swellings are the rule. The patient may thus suffer for twenty-four or seventy-two hours before the acute prostrating effects of the disease become evident. Some cases show almost complete recovery after such prodromata, and are then again taken ill suddenly or may go on to recovery, forming the abortive type.

The cerebro-spinal fluid in the prodromal stage may show opalescence with very marked lymphocytosis. The blood changes are not constant. A leukocytosis of 13,000 to 20,000 has been observed, while in some cases a leokopenia of from 3000 to 5000 exists.

After twenty-four to seventy-two hours or longer the temperature suddenly rises. It varies from 99 to 105 degrees and bears little relation to the severity of the disease. Abortive cases have shown high temperatures and severe cases low temperatures. Chills and convulsions occasionally attend the rise in temperature.

Headache is a frequent symptom. It is often severe, may be frontal or occipital, resembling a meningeal headache. Prostration is marked and vomiting is frequent. The respiratory symptoms are not marked, save when respiratory palsies occur.

Early profuse sweating is frequent and skin eruptions are occasionally seen; herpes occurs in some epidemics, while in others it is seldom met. Nose bleed is a common feature.

As a rule there is considerable restlessness, especially in younger children. The children are peevish, petulant, or very fretty. Sleep is often disturbed with frequent crying, and some patients lie drowsy or apathetic. Pain is a frequent early symptom and at times very severe. Marked hyperthesia is usual and is brought on by the least attempt at motion. Movements of the head and spine are particularly painful and some patients are

* Read at Annual Conference of California Health Officers, Long Beach, October 1, 1925.

extremely anxious and fearful, whimpering continuously.

Photophobia is rather constant. The infiltration in the cord causes other sensory symptoms, such as paresthesia and anesthesia. Detraction of the head in some cases, and varying degrees of rigidity of the limbs with contracted position of the lower limbs, are frequent. Twitching and jerking of the limbs are also frequent. The disease may be arrested at any stage, going on to recovery or developing paralysis without abatement of symptoms, or after a few days' interval of apparent good health.

1. *Spinal Forms.* There is usually an early prodromal weakness or even a paresis which is very widespread. This develops to a relatively marked paralysis within twelve hours to five days. It begins with weakness, advances to paresis, and finally becomes a definite paralysis. Whereas the weakness is generally widespread, the palsies are less so and the paralysis even more restricted. When the ultimate stages are finally reached, the residual paralyses often represent but a small part of what appeared to be a wholesale devastation.

Any muscle of the body may be involved. Involuntary muscles are frequently implicated with chronic ptoses, vascular disorders and intestinal symptoms. Special muscle groups are picked out. In the lower extremity the quadriceps, the peronei, and tibialis anticus are the oftenest affected; in the upper extremities the scapular and deltoid muscles. The trunk muscles are involved next more frequently, while the arms are least frequently involved.

In young children it is almost impossible to locate the paralyses in the early stages, especially as many such patients go through the initial stage of the disease without there being a suspicion of the real difficulty.

Weakness of the muscles of the abdomen is an important early diagnostic feature. The involvement is usually bilateral and diffuse. The muscles are hypotonic and swell out as though the intestines were inflated with gas. There is loss of the epigastric and abdominal reflexes and the patients are unable to come from a horizontal to a sitting position. Obstinate constipation usually accompanies the abdominal palsies. Of the back muscles the latissimus dorsi are the oftenest involved. The glutei are also somewhat implicated. Patients with these palsies waddle when they walk. The diaphragm is only rarely implicated. They are usually among the fatal cases.

Sensory disturbances are common. In the beginning of the disease there is marked hyperthesia. The slightest touch causes marked reaction.

The bladder is frequently involved, retention is common, incontinence rare.

2. *Acute Ascending Form—Landry's Paralysis.* The disease described by Landry is, for the most part at least, a true polio-encephalomyelitis. The palsy shows itself first in the lower extremities, then the muscles of the hip, the abdomen, the thorax and the cranial nerves are involved, and death generally occurs through implication of the cardiac and respiratory centers, death usually taking place in from two to five days.

3. *Bulbar Form.* In this type the features that stand in the foreground are the cranial nerve palsies. The first nerve appears to escape or is not detected. Involvement of the second produces photophobia which may be particularly marked at the outset. Complete ocular motor paralysis occurs when the third, fourth and sixth nerves are affected. In these cases the patient is unable to move the eye in any direction and has to depend on moving the head and take a chance on the eye coming in line with the object desired to be looked at. When the third is involved alone, ptosis results. The fourth nerve may occasionally be affected. The patient has a diplopia which comes on when he looks downward and outward. The false image is lower than the true and the upper end is tilted toward the true image. The sixth nerve is frequently involved and the patient is unable to turn the eye outward beyond the middle point. The patient also has a diplopia on looking outward. When the fifth nerve is totally paralyzed, there is anesthesia on the same side of the face. The motor fibres of this nerve are most frequently involved.

The facial or seventh is perhaps the most frequently affected of all. The paralysis of this nerve in poliomyelitis can very easily be mistaken for paralysis due to neuritis after it leaves the stylomastoid feramen, the so-called Bell's paralysis; but in poliomyelitis there is very apt to be an accompanying sixth nerve involvment in the bulbar lesions affecting the facial nerve. If the lesion is within the Fallopian aqueduct there is a loss of taste in the anterior two-thirds of the tongue, and sometimes disturbances of secretion of saliva. If these later conditions are present, it might be regarded as a point against the condition being poliomyelitis.

When the eighth is affected, the danger one would expect to find would be either deafness or vertigo. Paralysis of the glossopharyngeal nerve produces difficulty in swallowing and a loss of taste. It is quite probable that the difficulty in swallowing seen in cases that ultmately prove fatal may be due to involvment of the ninth nerve.

If one pneumogastric is affected, there is paralysis of one side of the palate and there is a one-sided paralysis of the larnyx and anesthesia of the larnyx on the affected side. If both nerves are affected, there is profound alteration of the respiration and circulation. Respiration is slow and irregular and the heart beats very irregularly. In some cases there is Cheyne-Stokes breathing.

The eleventh nerve supplies the sterno-mastoid and part of the trapezius. Paralysis of this nerve shows itself in rotating the head, when the sterno-mastoid does not stand out prominently, as it does normally. The trapezius paralysis causes a downward and outward displacement of the scapula.

There is no question, both from a pathological and epidemiological point of view, that bulbar paralysis may be of poliomyelitic origin and be the only involvment; more frequently it is associated with involvment of the cord and such cases are then spoken of as bulbospinal. Paralysis of the cranial nerves has been considered, but it is necessary to add a word about some of the combinations. There may be various combinations of eye muscle affections, either alone or with other paralysis; there may be changes in the pupil, sometimes there is nystagmus; there may be marked changes in the voice, varying from slight hoarseness to complete aphonia; there may be difficulty in swallowing, there merely being a tendency to have the food enter the larnyx or, as it is expressed, to swallow the wrong way. Frequently these patients complain of having fluids return through the nasal passages.

4. *Encephalitic or Cerebral Form.* Here the inflammatory reaction spreads throughout the entire cortex and cord. In addition to headache, stupor and convulsions, one encounters spastic palsies, hemiplegic or diplegic in type, usually associated with bulbar palsies. This form is rare and often fatal.

5. *Cerebellar Forms.* These patients show ataxia in walking, with staggering gait. These forms are closely allied to the bulbar type.

6. *Meningitic Forms.* Here meningeal symptoms occupy the foreground. Headache, vomiting, pain in the neck with stiffness, opisthoto-

nos, convulsions, strabismus, somnolence. These patients are almost always found lying on their sides with their heads drawn back and their knees and thighs flexed.

7. *Poly-neuritic Forms.* The study of recent epidemics has shown the great frequency with which pain is found in the initial history.

8. *Vegetative Type.* The vegetative fibers are implicated with trophic and secretory disturbances. This form is confused with the so-called neurotic or functional cases of nervous disorders.

9. *The Abortive Form.* This has been divided into four classes: those with the course of a general infection; those showing meningeal irritation; those with marked pain, suggesting influenza; and those with gastro-intestinal disturbances. A fifth might be added for the purpose of drawing attention to it—those beginning with definite sore throat.

It should be borne in mind that poliomyelitis is a disease which probably in a very large proportion of cases does not involve the nervous system to such an extent as to cause special symptoms, and the cases characterized as abortive are merely those which go through the pre-paralytic stage without having any definite paralysis follow. What is true of the abortive cases is equally true of the pre-paralytic stage of the ordinarv form of the disease. A great number of the abortive cases have muscular weakness, or even paralysis of a very limited amount.

The onset of the disease is not unlike that of any febrile disturbance. One of the most striking characteristics of the onset is the alternating irritability and somnolence of the patient. The patient is flushed and the eyes have a peculiar expression. The cornea and sclera are glazed, frequently there is a puffiness of the circum orbital tissue and a look of apprehension and resentfulness. The usual activity has gone, and quietly and without complaining they simply cease to move about. There may be a slight redness of the throat and a coated tongue. Slight tenderness may be found on bending the neck forward, or, by forcing the Kernig manipulation for both of these procedures, cause anterior spinal flexion. The clinical picture at this stage does not show any sign of central nervous system involvment. These symptoms may continue for a day or two and gradually clear up.

It may be well to state in mild cases differentiation from trivial disorders is impossible. In epidemic times every case which can not be definitely diagnosed should be viewed with suspicion and watched closely.

In the presence of an epidemic particular attention should be given to all acute infections, whether they show marked palsies or not, and careful examination should be made for nerve tenderness, changes in tendon reflexes and limb motility. Most cases develop in the guise of general infections with temperature, or with distinct local symptoms—either in the respiratory or intestinal tracts. Influenza, poliomyelitis, bronchitic gastro-enteritis, typhoid fever, paralysis occurring with typhus, diphtheritic paralysis and rheumatism come into view.

Poly-neuritis offers particular difficulties. This is rare in children, apart from diphtheritic neuritis, and is usually quite symmetrical in its development. The time needed for the development of the paralysis is longer and the pains more persistent and early edema are more frequent.

In diphtheritic neuritis, cardiac irregularities are the rule; in poliomyelitis, the exception. The palsies of the palate are further characteristic in the former and throat cultures may be of assistance.

In the meningitic forms, and many of the ordinary spinal cases, the separation from spinal or tuberculous meningitis is very difficult. The lumbar puncture usually clears up the diagnosis. Clinically, the more marked mental symptoms, the marked degree of stiffness of the spinal column and at times papillary edema, ear complications and herpes, all speak for meningitis. In tuberculous meningitis the spinal fluid findings and the longer course of the disease establishes the diagnosis. The spinal puncture should not be made until all conditions have been ruled out. In poliomyelitis the findings are uncertain; it may be clear or cloudy, released under pressure or of a normal pressure; the cell count may be normal, slightly or greatly increased.

In epidemics of encephalitis the course of the symptoms runs a longer course, while in poliomyelitis the extent of the paralysis is generally accomplished in a few days. If there is a state of somnolence, marked asthenia, fever of an irregular type and cranial nerve palsies, encephalitis should be suspected.

It may be unsafe or unwise at this time to go on record as saying that poliomyelitis and encephalitis are one and the same disease, but it appears safe to say that they are closely related and undoubtedly of the same group.

Bacteriologists have long classified bacteria into groups and these groups produce diseases, clinically closely allied. Clinically, poliomyelitis and encephalitis are closely related and their manner of spread from person to person is the same. From the standpoint of health officials group infection is what is to be desired and in the group here referred to it may have to be extended to include influenza.

All health and success does me good, however far off and withdrawn it may appear; all disease and failure helps to make me sad and does me evil, however much sympathy it may have with me or I with it.—Henry David Thoreau.

MORBIDITY.*

Diphtheria.

107 cases of diphtheria have been reported, as follows: Los Angeles 38, Los Angeles County 11, San Francisco 7, Fresno 5, Long Beach 3, San Diego County 1, Santa Barbara 3, Redondo 1, Daly City 1, Humboldt County 2, Santa Clara County 3, Santa Cruz County 1, Woodland 2, Oakland 4, Salinas 1, Kern County 2, Compton 1, South Gate 2, Fullerton 1, San Luis Obispo County 1, Fowler 1, Sacramento 3, Turlock 1, Beverly Hills 1, Yuba City 1, Lodi 1, San Joaquin County 3, Stockton 2, Ventura County 1, Butte County 1, Venice 1, San Jose 1.

Scarlet Fever.

150 cases of scarlet fever have been reported, as follows: Los Angeles County 26, Los Angeles 23, San Francisco 16, Santa Clara County 9, San Jose 5, Stockton 8, Butte County 6, Oakland 3, Lake County 1, Woodland 1, Alameda County 1, Calistoga 2, Ontario 3, Kern County 4, Riverside 1, Huntington Park 1, Compton 2, Torrance 1, San Fernando 1, Hermosa 4, Maywood 2, South Gate 2, Burbank 1, San Diego County 3, Merced County 1, Tulare County 2, Bakersfield 1, San Luis Obispo County 1, Long Beach 2, Mendocino County 1, Fresno County 3, Fresno 2, Sacramento 4, Turlock 3, Oceanside 1, Escondido 2, Gridley 1.

*From reports received on November 30th and December 1st, for week ending November 28th.

Measles.

9 cases of measles have been reported, as follows: Oakland 1, Whittier 1, Los Angeles 2, Los Angeles County 1, Sacramento 1, Berkeley 1, San Francisco 2.

Smallpox.

46 cases of smallpox have been reported, as follows: Oakland 17, Los Angeles 6, Mendocino County 5, Lincoln 6, Daly City 1, Long Beach 2, San Joaquin County 1, Richmond 3, Los Angeles County 4, Santa Cruz 1.

Typhoid Fever.

16 cases of typhoid fever have been reported, as follows: Fresno 2, Riverside 1, Fresno County 1, Ventura 1, Orland 1, Los Angeles County 3, Shasta County 2, Long Beach 1, San Francisco 3, Sacramento 1.

Whooping Cough.

40 cases of whooping cough have been reported, as follows: San Francisco 9, Oakland 8, Alameda 5, Berkeley 3, Alameda County 2, Los Angeles 4, Santa Barbara 3, Los Angeles County 1, Orland 4, Long Beach 1.

Poliomyelitis.

9 cases of poliomyelitis have been reported, as follows: San Francisco 4, Oakland 1, Fresno County 2, Alhambra 1, Marysville 1.

Epidemic Encephalitis.

3 cases of epidemic encephalitis have been reported, as follows: Tulare County 1, Los Angeles 1, San Fernando 1.

COMMUNICABLE DISEASE REPORTS.

Disease	1925				1924			
	Week ending			Reports for week ending Nov. 28 received by Dec. 1	Week ending			Reports for week ending Nov. 29 received by Dec. 2
	Nov. 7	Nov. 14	Nov. 21		Nov. 8	Nov. 15	Nov. 22	
Anthrax	0	0	0	0	0	0	1	0
Chickenpox	210	173	246	200	244	201	264	198
Diphtheria	136	127	141	107	215	188	171	193
Dysentery (bacillary)	1	4	0	0	0	10	0	0
Epidemic encephalitis	2	3	0	3	6	1	4	4
Epidemic meningitis	0	3	3	0	3	1	2	3
Gonorrhoea	134	81	239	106	102	75	73	97
Influenza	6	20	18	16	15	14	26	23
Leprosy	0	1	0	0	0	0	0	1
Malaria	2	1	0	2	1	2	0	0
Measles	13	13	17	9	35	24	35	24
Mumps	161	203	179	191	64	66	107	75
Pneumonia (lobar)	44	63	35	33	64	114	55	52
Poliomyelitis	11	16	13	9	10	10	7	12
Scarlet fever	102	124	170	150	131	112	137	144
Smallpox	32	66	41	46	105	98	97	73
Syphilis	212	105	200	94	68	166	132	99
Tuberculosis	183	166	198	117	136	179	118	200
Typhoid fever	16	14	17	16	27	23	82	21
Whooping cough	71	56	30	40	76	74	101	64
Totals	1336	1239	1547	1139	1302	1358	1412	1283

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